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the backside structures which does not completely fill the trenches/holes. The encapsulant can be deposited by spray coating.

Electrical interconnects **42** are formed on the rerouted contact pads **38a**. Electrical interconnects **42** can be ball grid array (BGA), plated bump, conductive adhesive bump, gold stud bump or any other appropriate interconnection methods. Preferably, the interconnect bumps are solder ball grid array. Wafer level dicing/singulation of components through the scribe lines that run through trenches **32** is then done using mechanical blade dicing equipment or any other appropriate processes, which extends through the encapsulation **40**, part of the dam **26** and the transparent substrate **24**. This singulation involves no cutting through the silicon substrate, and only partially through the dam **26**, as shown in FIG. **13**.

The final singulated die sensor package is shown in FIG. **14**. The sides of the sensor die are encapsulated so that there is no exposed silicon of substrate **10** (i.e. the side portions of substrate **10** are protected/sealed by insulation layer **36** and encapsulation **40**). Further, the sensor active area is never exposed once the dam **26** and transparent substrate **24** are formed thereon early in the process.

It is to be understood that the present invention is not necessary limited to the embodiment(s) described above and illustrated herein, but encompasses any and all variations falling within the scope of the claims. For example, the dam structure can be omitted, whereby the cavity is formed into the bottom surface of the protective substrate by etching of the substrate material. References to the present invention herein are not intended to limit the scope of any claim or claim term, but instead merely make reference to one or more features that may be covered by one or more claims. Materials, processes and numerical examples described above are exemplary only, and should not be deemed to limit any eventual claims. Further, not all method steps need be performed in the exact order illustrated, but rather in any order that allows the proper formation of the packaged image sensor. Lastly, single layers of material could be formed as multiple layers of such or similar materials, and vice versa.

It should be noted that, as used herein, the terms “over” and “on” both inclusively include “directly on” (no intermediate materials, elements or space disposed therebetween) and “indirectly on” (intermediate materials, elements or space disposed therebetween).

Likewise, the term “adjacent” includes “directly adjacent” (no intermediate materials, elements or space disposed therebetween) and “indirectly adjacent” (intermediate materials, elements or space disposed there between), “mounted to” includes “directly mounted to” (no intermediate materials, elements or space disposed there between) and “indirectly mounted to” (intermediate materials, elements or spaced disposed there between), and “electrically coupled” includes “directly electrically coupled to” (no intermediate materials or elements there between that electrically connect the elements together) and “indirectly electrically coupled to” (intermediate materials or elements there between that electrically connect the elements together). For example, form-

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ing an element “over a substrate” can include forming the element directly on the substrate with no intermediate materials/elements therebetween, as well as forming the element indirectly on the substrate with one or more intermediate materials/elements therebetween.

What is claimed is:

1. A sensor package, comprising:

a first substrate with opposing first and second surfaces, a plurality of photo detectors formed on or under the first surface of the first substrate and configured to generate one or more signals in response to light incident on the first surface of the first substrate,

a plurality of contact pads formed at the first surface of the first substrate and which are electrically coupled to the plurality of photo detectors,

a plurality of holes each formed into the second surface of the first substrate and extending through the first substrate to one of the contact pads, and

conductive leads each extending from one of the contact pads, through one of the plurality of holes, and along the second surface of the first substrate, wherein the conductive leads are insulated from the first substrate; one or more trenches formed into a periphery portion of the first substrate each extending from the second surface to the first surface; and

insulation material covering sidewalls of the one or more trenches.

2. The sensor package of claim **1**, further comprising:

a dam structure formed on the first surface of the first substrate and around but not over the plurality of photo detectors;

a second substrate disposed on the dam structure and extending over the plurality of photo detectors, wherein the dam structure and the second substrate form a sealed cavity over the plurality of photo detectors.

3. The sensor package of claim **1**, further comprising:

a second substrate disposed on the first surface and extending over the plurality of photo detectors, wherein a cavity formed into a surface of the second substrate is positioned over and seals the plurality of photo detectors.

4. The sensor package of claim **1**, further comprising:

a plurality of electrical connectors each electrically connected to one of the conductive leads.

5. The sensor package of claim **4**, further comprising:

a layer of insulation material disposed over the second surface of the first substrate and covering the conductive leads except for contact pad portions thereof which are in electrical contact with the plurality of electrical connectors.

6. The sensor package of claim **1**, further comprising:

a layer of insulation material between each of the conductive leads and the first substrate.

7. The sensor package of claim **1**, wherein each of the plurality of holes has a funnel shaped cross section.

8. The sensor package of claim **1**, wherein the sidewalls of the one or more trenches include a shoulder formed therein.

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